Review

GPS-Based Approaches to Assessing Psychosocial Health in Community-Dwelling Older Adults: Integrative Review

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Abstract

Background: Psychosocial health in later life is closely related to how older adults move through and engage with their everyday environments. GPS technology enables repeated, individual-level assessment of real-world mobility, activity locations, and environmental contexts. However, GPS-based studies of psychosocial health among community-dwelling older adults have used heterogeneous devices, monitoring protocols, derived measures, and analytic approaches.

Objective: This integrative review aimed to synthesize associations between individual-level GPS-derived measures or GPS-anchored environmental exposures and psychosocial health, operationalized as psychological health, social health, and evaluative well-being, among community-dwelling older adults. It also aimed to characterize GPS devices, monitoring protocols, and measures. Finally, it sought to identify methodological limitations and evidence gaps.

Methods: Systematic searches were conducted in PubMed, CINAHL, Embase, Web of Science, and the Cochrane Library from database inception to July 10, 2026. Studies were eligible if they included community-dwelling adults aged 60 years or older; used repeated, individual-level GPS coordinates or trajectories to derive or anchor measures of mobility, life space, activity patterns, or environmental exposure; and analyzed these measures in relation to at least one psychosocial health indicator. For narrative synthesis, psychosocial indicators were grouped into psychological health, social health, and evaluative well-being.

Results: Of 1499 records identified, 15 reports representing 13 independent studies were included. GPS-based measures were classified into three nonmutually exclusive domains: (1) mobility and life space measures, (2) activity locations and patterns, and (3) GPS-anchored environmental exposure. Across studies, associations between GPS-based measures and psychosocial indicators were heterogeneous. Greater mobility, including more outdoor time, greater travel distance, more frequent trips, and larger activity spaces, was associated with more favorable indicators of psychological health, social health, or evaluative well-being in several reports, although null findings were also common. Some activity-location and movement-pattern measures showed associations with depressive symptoms, perceived social isolation, life satisfaction, and relaxation. GPS-anchored environmental exposure was examined in 3 independent studies. Substantial heterogeneity was observed in GPS devices, monitoring duration, sampling intervals, valid-data criteria, data-processing procedures, and missing-data handling.

Conclusions: Repeated, individual-level GPS data can characterize real-world mobility, activity patterns, and environmental exposure in relation to psychosocial health among community-dwelling older adults. However, associations were heterogeneous and were based on observational analyses. Future studies should prioritize adequately powered longitudinal designs, repeated and temporally aligned assessments, and standardized and transparent GPS data processing.

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Introduction

Healthy aging is increasingly understood as a multidimensional process shaped by physical, psychological, social, and environmental factors [1]. Psychological functioning, social relationships, and individuals' evaluations of their quality of life and well-being are important aspects of healthy aging and have been associated with functioning, social participation, and life satisfaction in later life [2-4]. Understanding behavioral and contextual factors associated with these domains is therefore important for research on psychosocial health in later life.

Mobility in later life has been linked to health, independence, and social connectedness [5]. For example, restricted life space, referring to a limited geographic extent of movement in daily life, has been associated with depressive symptoms among community-dwelling older adults [6]. Mobility provides opportunities to access services, maintain social relationships, and participate in meaningful activities [5], and may therefore be associated with psychological, social, and evaluative well-being. Accordingly, mobility and life space provide important behavioral contexts for examining psychosocial health in older adults. However, repeated patterns of mobility in daily life can be challenging to characterize using retrospective self-report measures alone.

GPS technology provides an approach for characterizing daily-life mobility through repeated measurement of individual-level movement. GPS data can be used to derive measures such as travel distance, time spent outside the home, activity-space extent (the geographic area covered by an individual's recorded locations), the number of visited locations, and the regularity or variability of movement across observations [7,8]. By recording where and when movement occurs, GPS data can complement retrospective self-report measures by providing spatial and temporal information on daily mobility. GPS data can also be linked to environmental information to characterize exposures encountered along daily mobility paths, such as green or blue spaces, facilities, and road-network characteristics [9,10]. Thus, GPS-derived measures can characterize individual mobility and activity patterns, whereas GPS-anchored environmental measures can characterize environmental contexts linked to GPS-observed locations or mobility paths.

GPS-based studies have examined associations of these behavioral and contextual measures with psychological health, social health, and evaluative well-being among older adults [9-13]. However, GPS-based health studies have differed substantially in device type, monitoring duration, sampling frequency, valid-data criteria, preprocessing procedures, missing-data handling, and the operationalization of derived measures [7,14]. GPS data may also be incomplete because of signal loss, battery issues, or participant noncompliance [14]. Existing reviews have focused on GPS-based mobility measurement among community-dwelling older adults, mobility and well-being in later life, GPS data collection and processing, or associations between GPS mobility features and depressive symptoms across adult populations [5,7,14,15]. However, to our knowledge, no review has jointly synthesized repeated, individual-level GPS-derived and GPS-anchored environmental measures in relation to psychosocial health among community-dwelling older adults. In this review, psychosocial health was operationalized as encompassing 3 related domains: psychological health, social health, and evaluative well-being, reflecting psychological functioning, social relationships, and evaluations of life satisfaction and quality of life [16,17]. Therefore, this integrative review aimed to (1) synthesize evidence on associations between individual-level GPS-derived or GPS-anchored environmental measures and psychosocial health indicators, specifically, psychological health, social health, and evaluative well-being, among community-dwelling older adults; (2) characterize GPS devices and monitoring protocols, as well as the GPS-derived or GPS-anchored environmental measures used; and (3) identify methodological limitations and evidence gaps.

Methods

Study Design

This integrative review was conducted based on the methodological framework proposed by Whittemore and Knafl [18]. An integrative review approach was selected because the literature on GPS-based measures and psychosocial health in older adults encompasses heterogeneous study designs, monitoring protocols, derived measures, and outcome domains. The Whittemore and Knafl framework provides a systematic approach to synthesizing evidence across such diverse methodologies. The review protocol was registered in the PROSPERO (International Prospective Register of Systematic Reviews; CRD420251157640). This review was reported in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [19]. The PRISMA checklist is provided in Checklist 1.

Search Strategies

Systematic searches were conducted in PubMed, CINAHL, Embase, Web of Science, and the Cochrane Library from database inception to July 10, 2026. The search strategies were developed in consultation with a medical librarian, using database-specific subject headings and keywords related to GPS technology, psychosocial health, and older adults. In this review, psychosocial health was operationalized as comprising 3 domains: psychological health, social health, and evaluative well-being. Psychological health included mental health conditions and symptoms, psychological distress, and emotional or affective states; social health included social connectedness, social isolation, loneliness, and social engagement; and evaluative well-being included

life satisfaction and perceived or health-related quality of life. Detailed search strategies for each database are available in Multimedia Appendix 1.

Eligibility Criteria

Studies were included if they (1) used repeated, individual-level GPS coordinates or trajectories to derive measures of real-world locations, mobility, life space, activity patterns, or to link environmental attributes to GPS-observed locations or mobility paths; (2) included community-dwelling older adults aged 60 years or older, or findings for this age group were separately extractable; (3) assessed at least one indicator of psychological health, social health, or evaluative well-being; (4) analyzed GPS-derived or GPS-anchored environmental measures in relation to at least one psychosocial health indicator; and (5) were published in peer-reviewed journals. In this review, older adults were defined as individuals aged 60 years or older, in accordance with the United Nations standard used by the World Health Organization [20].

Studies were excluded if they (1) used geospatial measures without repeated, individual-level GPS data; (2) used GPS solely for mapping, visualization, adherence monitoring, assessment triggering, diary validation, or retrospective reconstruction; (3) did not directly analyze GPS-derived or GPS-anchored environmental measures in relation to psychosocial health indicators; (4) were conducted exclusively in inpatient or institutional settings; (5) were conference abstracts, reviews, study protocols, editorials, case reports, or unpublished theses and dissertations; (6) were not published in English. After protocol registration, the review scope was further refined to include peer-reviewed journal articles only, and the outcome scope was broadened from psychological and emotional health to psychosocial health. For narrative synthesis, psychosocial outcomes were categorized into psychological health, social health, and evaluative well-being.

Study Screening and Selection

After completing database searches, all identified records were imported into EndNote X9 (Clarivate Analytics), where duplicate entries based on titles, authors, and publication year were removed. Two researchers (JH and HK) independently screened titles and abstracts according to the predefined eligibility criteria. Subsequently, full-text screening was conducted. Any discrepancies were reviewed by a third researcher (BK), who examined the full text and facilitated consensus through discussion among the review team. Final selection of reports was determined through this consensus-based process.

Quality Appraisal of the Selected Studies

The quality of the selected reports was evaluated using the Mixed Methods Appraisal Tool (MMAT [21]). The MMAT is designed to assess the quality of various study designs, including quantitative, qualitative, and mixed methods studies and includes 5 criteria tailored to each study design. Each criterion was rated as “yes,” “no,” or “can’t tell.” Two researchers (JH and HK) independently assessed the quality of each study, and disagreements were resolved through discussion with the third researcher (BK). We summarized overall study quality using asterisks (*), ranging from none (fulfilling none of the criteria) to ***** (fulfilling all 5 criteria).

Data Extraction and Synthesis

Data extraction was conducted using a standardized form in Microsoft Excel. Two research assistants independently extracted data from each included report, and 2 researchers (JH and HK) reviewed and validated all extracted information. Any discrepancies were resolved through discussion with the third researcher (BK). Extracted data included study characteristics (author, publication year, country, study aims, sample size, and participant age); GPS devices and monitoring protocols; GPS-derived or GPS-anchored environmental measures and their operational definitions; psychosocial health indicators; reported associations; and methodological and technological limitations. Companion reports originating from the same parent study were also identified during data extraction. GPS-derived measures refer to variables calculated directly from repeated GPS coordinates or trajectories, whereas GPS-anchored environmental measures refer to variables obtained by linking environmental attributes to GPS-observed locations or mobility paths.

Data synthesis followed the 5-step process described by Whittemore and Knafl [18]. First, extracted data were organized in Microsoft Excel (*data reduction*). Specifically, psychosocial indicators were initially extracted as reported in each report and subsequently categorized into 3 domains: psychological health, social health, and evaluative well-being. Second, the reduced data were summarized into tables describing study characteristics, GPS devices and monitoring protocols, GPS-derived or GPS-anchored environmental measures, psychosocial health indicators, and reported associations (*data display*). Third, findings were compared across reports to identify similarities, differences, and patterns (*data comparison*). Fourth, the findings were integrated and interpreted across the 3 psychosocial health domains (*conclusion drawing*). Fifth, synthesized findings were reviewed and verified through iterative discussions among the research team (*verification*).

The report was the unit of extraction, whereas companion reports from the same parent study were linked and counted as a single independent study when describing and interpreting the evidence base.

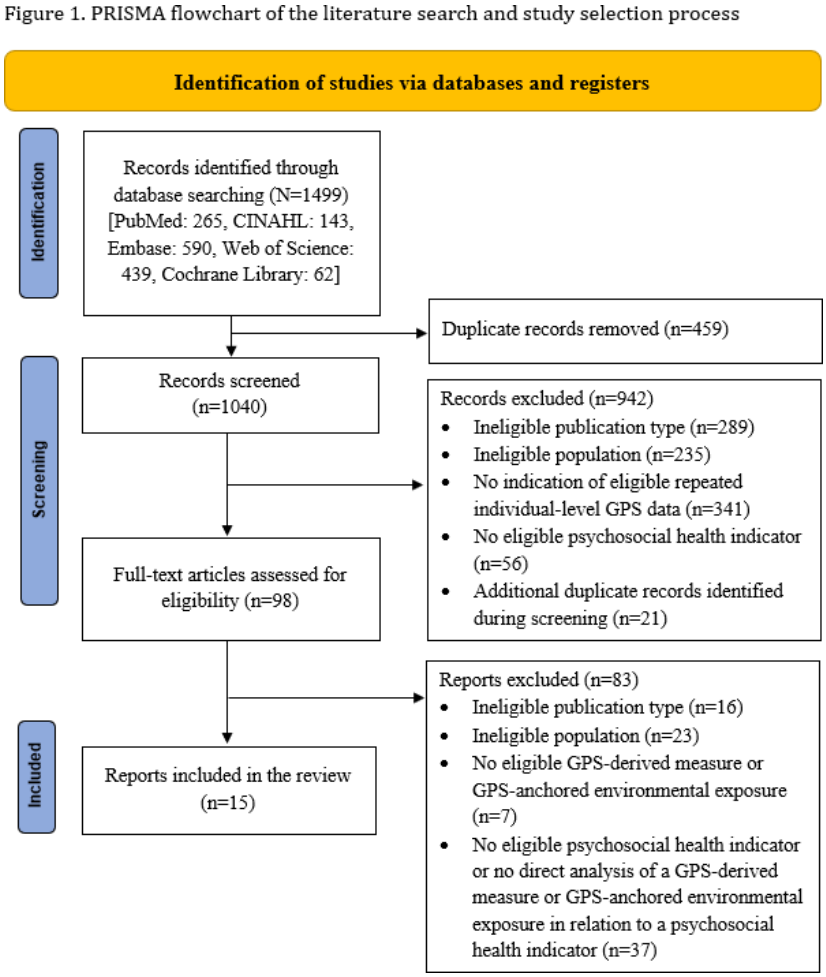
Results

Selection of Studies

Across the 5 databases, 1499 records were identified: 265 from PubMed, 143 from CINAHL, 590 from Embase, 439 from Web of Science, and 62 from the Cochrane Library. After removing 459 duplicates, 1040 records remained for

title and abstract screening, during which 942 records were excluded. Subsequently, 98 reports were assessed through full-text review, and 83 were excluded. Consequently, 15 reports representing 13 independent studies were included in the review. Figure 1 summarizes the literature search and the study selection process.

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart of the literature search and study selection process.



Characteristics of Included Studies

The 15 included reports represented 13 independent studies and were conducted across 4 geographic regions: Asia (Hong Kong, Japan, and China), Europe (France, Germany, and Switzerland), North America (Canada and the United States), and Oceania (Australia). Sample sizes varied substantially across studies, ranging from 8 to 279 participants, although analysis-specific sample sizes were not consistently reported.

Two companion reports from one parent study, focused on older adults with cognitive impairment [12,22], were included, and detailed characteristics and key findings of the included reports are provided in Multimedia Appendix 2.

All analyses relevant to this review were observational. Although 4 reports used secondary data from 2 parent randomized controlled trials, they did not compare randomized groups or estimate randomized intervention effects [12,22-24]. Accordingly, all 15 reports were appraised using the MMAT criteria for quantitative nonrandomized studies. Based on the MMAT appraisal, 6 reports met 80% of the criteria (****), 5 reports met 60% (***), 3 reports met 40% (**), and 1 report met 20% (*). Detailed results of the quality appraisal for each report are presented in Multimedia Appendix 3.

GPS Technologies, Monitoring Protocols, and GPS-Derived or GPS-Anchored Environmental Measures

Across the 13 independent studies, GPS data were collected using dedicated portable GPS loggers or receivers (n=6 independent studies, represented by 8 reports) [9,11,12,22-26], smartphone-based GPS (n=5 independent studies) [10,27-30], or wearable GPS devices (n=2 independent studies) [13,31]. Ten reports collected complementary data using accelerometers, pedometers, inertial sensors, ecological momentary assessment, diaries, or other sensing devices alongside GPS data [9-13,23-25,27,28].

Monitoring protocols varied in assessment duration, sampling frequency, and criteria for valid GPS data. Eight reports collected GPS data over approximately 6 to 15 days [9-11,13,22-24,28], and 4 used monitoring periods of approximately 4 to 8 weeks [26,27,29,30]. One report used

three daytime monitoring days [31], one assessed a single park visit [25], and one did not report the total GPS monitoring duration [12]. Where reported, sampling intervals ranged from 1 Hz [13,29] to 1 location fix every 2 minutes [10]. The raw GPS sampling interval was not reported in 2 reports [24,28]. Criteria for valid data included minimum daily monitoring time, a minimum number of valid days, and requirements for valid home and activity-location data [11-13,22-24]. Detailed GPS technologies and monitoring protocols are presented in Multimedia Appendix 4.

The measures were classified into 3 nonmutually exclusive domains: (1) GPS-derived mobility and life space, (2) GPS-derived activity locations and patterns, and (3) GPS-anchored environmental exposure. Mobility and life space measures were examined in 11 of the 13 independent studies, represented by 13 reports, including outdoor or out-of-home time, travel distance, activity-space area, maximum distance from home, and trip frequency and duration [10-13,22-24,26-31]. Eight independent studies examined activity locations and patterns, including visited destinations, location entropy (a measure of how evenly time is distributed across visited locations), significant locations, route diversity and familiarity, and park-use patterns [9-11,13,25,26,29,30]. Three independent studies examined GPS-anchored environmental exposures, including facilities and road intersections, green- and blue-space characteristics, microurban features encountered along mobility paths, and park-zone attributes [9,10,25].

Psychosocial Health Indicators

Psychosocial health indicators examined in relation to GPS-derived measures or GPS-anchored environmental exposures were organized into three domains: (1) psychological health, (2) social health, and (3) evaluative well-being. Studies could contribute to more than one domain.

Psychological health indicators were examined in 13 reports representing 11 independent studies [9,10,12,13,22-26,28-31]. Depressive symptoms were the most frequently assessed indicator and were examined in 11 reports representing 9 independent studies [9,12,22-26,28-31]. Other indicators included anxiety, relaxation, and contentment [25]; psychological well-being [12,22]; positive and negative affect [13]; happiness and calmness [10]; and fear of falling [23,24].

Social health indicators were examined across 4 reports representing 4 independent studies. These indicators included loneliness [11,28], perceived social isolation [27,29], social interactions [11], perceived help availability and social network [28], sense of belonging [27], and community participation [29].

Evaluative well-being indicators were examined across 4 reports representing 4 independent studies, including life satisfaction [13], daily satisfaction [10], perceived quality of life [23], and health-related quality of life [11].

Psychosocial Health in Relation to Mobility and Life Space Measures

Associations between mobility and life space measures and psychosocial health indicators were heterogeneous, with both significant and null findings across reports. Association directions, participant sample sizes, and covariate-adjustment status are summarized by GPS measure domain and psychosocial health domain in Multimedia Appendix 5.

For psychological health, longer outdoor or out-of-home time was associated with fewer depressive symptoms [12,26], whereas 12-month change in outdoor time was not associated with changes in depressive symptoms [22]. Outdoor time was not associated with psychological well-being [12], and 12-month change in outdoor time was not associated with changes in psychological well-being [22]. Spending at least 30 minutes outdoors per day was associated with fewer depressive symptoms and less fear of falling [23], and greater pedestrian trip frequency, distance, and duration were associated with fewer depressive symptoms and less fear of falling [24]. In the study by Giannouli et al [28], GPS-derived life space measures were not associated with depressive symptoms. In the study by Chung et al [31], no significant associations were observed in unadjusted analyses; however, after demographic adjustment, 95th-percentile movement speed was positively associated with depressive symptoms. Positive affect was not reliably associated with daily mobility measures [13]. In the study by Wang et al [10], activities occurring within the residential neighborhood were associated with lower momentary happiness.

For social health, a greater number of out-of-home trips was associated with more social interactions but not with loneliness [11]. Greater distance traveled from home was correlated with a stronger sense of belonging [27], and maximum action range showed a small association with perceived help availability but not with loneliness or social networks [28]. A relative-mobility component was also associated with community participation [29].

For evaluative well-being, outdoor time was not associated with perceived quality of life [23], and out-of-home trips were not associated with health-related quality of life [11]. In contrast, a larger activity-space ellipse (an ellipse summarizing the spatial distribution of recorded locations) was associated with greater daily satisfaction [10], and larger daily convex-hull areas (the areas of the smallest convex polygons enclosing the recorded GPS locations) and more passive-transport time were associated with higher daily life satisfaction [13].

Psychosocial Health in Relation to Activity Locations and Patterns

Associations with activity-location and movement-pattern measures also varied across psychosocial health indicators. For psychological health, higher depressive-symptom scores were correlated with fewer unique driving routes [30], whereas no association between GPS-derived location-pattern measures and depressive symptoms remained after correction for multiple comparisons in the study by Hackett et al [29]. The between-person association between location entropy and negative affect was not robust after adjustment [13]. Among older park users, GPS-derived park-use classes

differed in postvisit relaxation, with active park lingerers reporting greater relaxation than active walkers [25].

For social health, lower mean location diversity and lower day-to-day variability in location diversity were associated with greater COVID-19–related social isolation [29], whereas destination-specific trip counts were not associated with loneliness [11].

For evaluative well-being, greater daily location entropy was associated with higher life satisfaction at the within-person level [13], whereas destination-specific trip counts were not associated with health-related quality of life [11].

Psychosocial Health in Relation to GPS-Anchored Environmental Exposures

GPS-anchored environmental exposures were examined in 3 independent studies, whereas direct associations with psychological health indicators were reported in 2. Exposure to water and to commercial, leisure, or cultural attractors along daily mobility paths was associated with better momentary mental well-being in selected models, and selected attractors and walkable paths were also associated with better momentary mental well-being in within-person outdoor analyses [9]. In the study by Wang et al [10], selected GPS-anchored environmental attributes, including leisure facilities, road intersections, and the blue-view index, were associated with momentary happiness or calmness. Li et al [25] also characterized GPS-anchored environmental attributes within the park setting; however, the reported psychological health comparison was based on GPS-derived park-use classes rather than a direct environmental exposure-outcome association.

Methodological and Technological Limitations

Methodological and technological limitations were identified across the included reports. Several reports did not fully specify key GPS protocol elements, including total monitoring duration, raw sampling interval, valid-day criteria, participant-level data-completeness thresholds, home-geofence definitions, and trip definitions [9-12,23-25,27-29]. The application of valid-data criteria reduced analytic samples in 8 reports [11-13,22,23,25,30,31]. Three reports excluded, imputed, or reconstructed missing or incomplete GPS observations using different procedures [9,13,29].

GPS measurement and processing procedures introduced additional limitations. Data collection in 4 reports depended on participants manually activating GPS recording or carrying a study or personal smartphone, creating the potential for unrecorded observation periods [27,29-31]. Travel modes and trips were not consistently distinguished or fully defined, and classification was potentially subject to misclassification in 5 reports [11,12,22,24,28]. In the 3 studies of GPS-anchored environmental exposure, limitations included reconstructed location points and potential indoor-outdoor misclassification, incompletely reported interpolation or missing-data handling, and incomplete GPS coverage [9,10,25].

Three reports used small analytic samples or conducted exploratory or unadjusted analyses, limiting the precision and interpretability of the reported associations [27,30,31]. Feasibility and acceptability of GPS-based monitoring were explicitly evaluated in 3 reports using different measures [11,29,31]. Reported issues included variable device-use time, incomplete GPS records, additional charging requirements, and occasional technical problems, although Gough et al [11] and Hackett et al [29] generally reported favorable protocol completion and participant experiences.

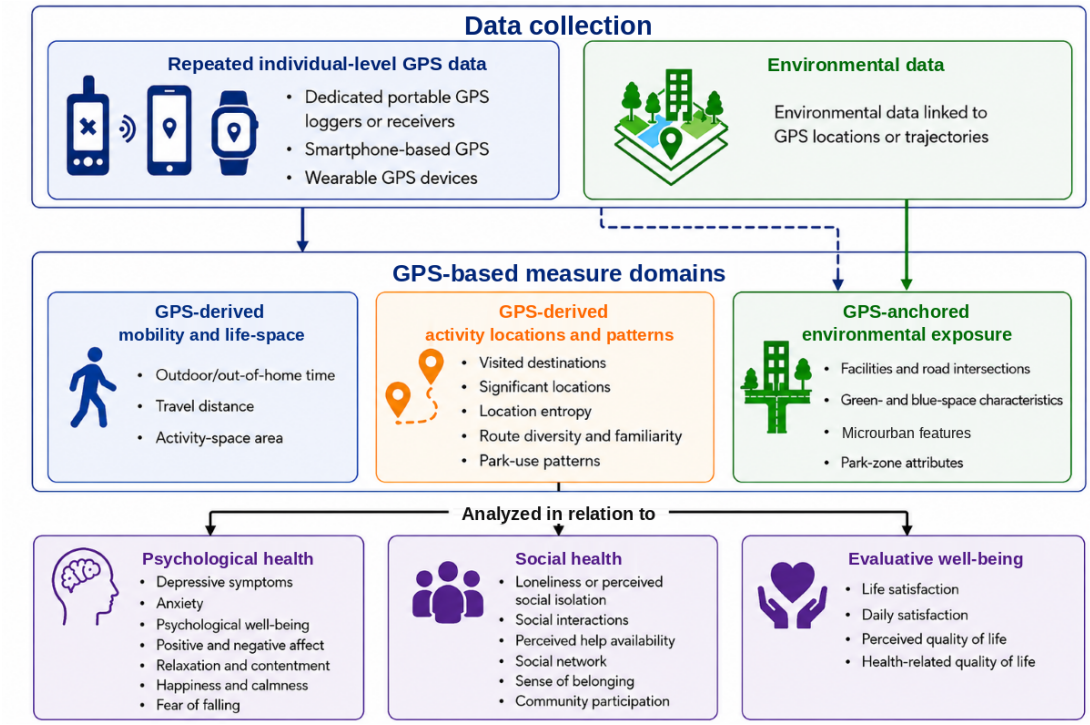
Discussion

Principal Findings

In this integrative review, we synthesized evidence from 15 reports representing 13 independent studies that used repeated, individual-level GPS data to examine psychosocial health among community-dwelling older adults. Overall, associations between GPS-based measures and psychosocial health indicators were heterogeneous, with both significant and nonsignificant findings reported across psychological health, social health, and evaluative well-being outcomes. GPS-derived mobility and life space measures were the most frequently examined indicators, whereas relatively few studies examined GPS-derived activity locations and patterns or GPS-anchored environmental exposures. Comparisons across studies were further limited by substantial variation in GPS devices, monitoring protocols, outcome measures, and analytic approaches, highlighting important methodological limitations and evidence gaps in the current literature [7,14,15].

To organize the evidence, GPS-based measures were classified into 3 nonmutually exclusive domains: GPS-derived mobility and life space, GPS-derived activity locations and patterns, and GPS-anchored environmental exposure. Consistent with our conceptual framework, psychosocial health outcomes were synthesized within 3 domains: psychological health, social health, and evaluative well-being. Figure 2 illustrates the relationships among repeated, individual-level GPS data, the 3 GPS measure domains, and the 3 psychosocial health domains examined in this review. This framework extends previous reviews focused primarily on GPS-based mobility measures and depressive symptoms by providing a broader synthesis of psychosocial health outcomes among community-dwelling older adults.

Figure 2. Conceptual summary of data sources, GPS-based measure domains, and the 3 psychosocial health domains examined among community-dwelling older adults.



The mobility and life space domain was the most frequently examined GPS measure domain, assessed in 11 independent studies represented by 13 reports. Several reports found associations between greater mobility, including more time spent outdoors, greater travel distance, more frequent trips, or larger activity spaces, and fewer depressive symptoms, more frequent social interactions, a stronger sense of belonging, or greater life or daily satisfaction [10-13,23,24,26,27]. However, findings varied across GPS measures, psychosocial indicators, and assessment periods, and several reports also reported null associations. One report that examined change over time found that changes in outdoor time over 12 months were not associated with changes in depressive symptoms or psychological well-being [22]. Taken together, these findings do not support interpreting GPS-derived mobility measures as direct proxies for psychosocial health. The predominantly cross-sectional evidence also precludes conclusions about temporal direction. A recent meta-analysis similarly found small-to-moderate between-person associations between several GPS-derived mobility and activity features and depressive symptoms in adults but insufficient evidence to synthesize within-person associations [15]. Future studies should therefore combine repeated GPS monitoring with repeated psychosocial assessments and within-person analyses to better characterize changes over time.

Activity locations and patterns were examined in 8 independent studies [9-11,13,25,26,29,30]. Measures such as location entropy, location diversity, route diversity, and park-use patterns captured aspects of the spatial distribution, diversity, and organization of daily activity beyond mobility volume alone. Associations were reported with depressive symptoms, perceived social isolation, life satisfaction, and relaxation [13,25,29,30]. However, the evidence was limited, and some findings were based on small samples, used unadjusted analyses, or did not remain significant after correction for multiple testing. Evidence regarding social health was particularly limited, with only 2 of the 8 studies in this GPS measure domain examining social health indicators [11,29]. Thus, although GPS-derived activity-location and movement-pattern measures may provide information about daily behavior beyond mobility volume, current evidence is insufficient to support their use as validated indicators of psychosocial health.

GPS-anchored environmental exposure was the least frequently examined domain, addressed in only 3 independent studies. Fancello et al [9] and Wang et al [10] directly examined associations between environmental characteristics encountered during daily mobility and psychosocial health indicators, whereas Li et al [25] characterized environmental attributes within a park setting but evaluated psychosocial differences primarily across GPS-derived park-use classes. In the studies by Fancello et al [9] and Wang et al [10], time-stamped GPS locations or trajectories were linked to environmental data to characterize exposures encountered during daily mobility. Such approaches can incorporate the spatial and temporal contexts in which exposure occurs rather than relying solely on residential location [32]. The small evidence base and observational study designs do not support causal interpretation. Future studies should more clearly define how GPS trajectories are linked to environmental data, including the spatial buffers and time windows used to define exposure.

GPS devices, monitoring periods, sampling intervals, valid-data criteria, preprocessing procedures, and missing-data handling varied substantially across reports. Several

reports did not fully specify one or more key GPS protocol elements; valid-data requirements reduced the analytic sample in 8 reports; and incomplete observations were excluded, imputed, or reconstructed using different procedures in 3 reports. These differences limited direct comparisons across studies. Previous reviews have similarly identified substantial heterogeneity in GPS data collection, processing, and reporting practices [7,14]. Greater consistency in reporting GPS devices or applications, sampling intervals, monitoring schedules, valid-day and valid-participant criteria, preprocessing procedures, missing-data handling, and derivation of GPS measures would facilitate comparisons across studies. Reporting the number of participants and observation days retained at each stage of GPS processing and analysis would further improve transparency. Analyses of repeated GPS data should also account for within-person dependence and, where applicable, multiple testing.

Feasibility or acceptability of GPS-based monitoring was evaluated in only 3 reports using different measures, limiting comparisons across studies [11,29,31]. The limited reporting of these outcomes in the remaining reports should not be interpreted as evidence that GPS-based assessment was burden-free. Four reports depended on participants manually activating GPS recording or consistently carrying a study or personal smartphone, creating the possibility of unrecorded observation periods [27,29-31]. The extent to which these requirements affected participant burden, adherence, or retention was not directly evaluated. Future studies should report participant burden, device-related difficulties, technical support provided, and reasons for missing GPS data or study withdrawal.

The collection of detailed GPS trajectories raises privacy and data-governance concerns, including how location data are accessed, stored, retained, and shared. GPS trajectories can reveal home locations, frequently visited places, daily routines, and visits to potentially sensitive locations. Relevant ethical considerations include informed consent, data security, transparency regarding secondary use, equity, and data ownership [33,34]. GPS-based studies should therefore minimize the collection and retention of identifiable location information where feasible; clearly communicate how location data will be collected, processed, stored, used, and shared; and implement appropriate safeguards for data access, transfer, retention, and sharing.

Overall, the included studies used repeated, individual-level GPS data to characterize daily mobility, activity locations and patterns, and GPS-anchored environmental exposures in relation to psychosocial health among community-dwelling older adults. However, the current evidence is insufficient to establish these measures as validated indicators of psychological health, social health, or evaluative well-being. Further research should use adequately powered longitudinal designs with repeated and temporally aligned GPS and psychosocial assessments, adjust for relevant confounders, report GPS data collection and processing transparently, and replicate findings across diverse populations and geographic settings. These approaches may clarify whether and under what conditions GPS-based measures provide information about psychosocial health beyond conventional self-report measures and residentially defined environmental exposures.

Limitations

This review has several limitations. First, psychosocial health was operationalized as psychological health, social health, and evaluative well-being. Other conceptualizations and domains of psychosocial health were outside the scope of this review and were not systematically synthesized. Because studies without repeated, individual-level GPS data were excluded, evidence on environmental exposures assessed solely from residential location was not synthesized. Second, substantial heterogeneity in GPS devices, monitoring protocols, valid-data criteria, data-processing procedures, derived measures, and analytic approaches limited direct comparisons across studies. Incomplete reporting and differences in the handling of missing or invalid GPS data further limited assessment of measurement quality and comparability. Third, all analyses relevant to this review were observational, limiting causal inference. Several reports also relied on small samples or exploratory, unadjusted, or bivariate analyses, limiting the precision and robustness of the synthesized evidence. Some nonsignificant associations, particularly those estimated in small samples, may reflect limited statistical power rather than the absence of an association. Fourth, the evidence base was geographically concentrated and included limited representation of rural, socioeconomically disadvantaged, and mobility-limited older populations, restricting the generalizability of the findings. Finally, after protocol registration, the review scope was refined to include peer-reviewed journal articles only; therefore, relevant gray literature may not have been captured.

Conclusions

This integrative review synthesized evidence from studies using repeated, individual-level GPS data to examine psychological health, social health, and evaluative well-being among community-dwelling older adults. GPS-derived measures were used to characterize mobility and life space as well as activity locations and patterns, whereas GPS-anchored environmental measures were used to characterize exposures encountered during daily mobility; however, associations with psychosocial health indicators were heterogeneous and based on observational analyses. Future research should prioritize adequately powered longitudinal designs, repeated and temporally aligned GPS and psychosocial assessments, standardized and transparent GPS data processing, protection of identifiable location data, and inclusion of diverse older populations to determine the validity, interpretability, and potential utility of these measures in aging research.

Generative AI Use

The authors declare that generative AI (GenAI) was used in the creation of this manuscript. GenAI (ChatGPT; OpenAI) was used to assist with the visual rendering of a figure based on an author-developed draft, as well as proofreading, editing, or language polishing; the authors reviewed and revised the AI-assisted output and take full responsibility for the final figure. The authors verified all outputs of the tool(s) used in the preparation of this manuscript and take full responsibility for the final content of the manuscript.

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Data Availability

All data supporting the findings of this review are available within the article and its multimedia appendices.

Authors' Contributions

JH designed the study, searched and selected the articles, performed the quality assessment, analyzed and interpreted the articles, and drafted and revised the manuscript. BK designed the study, analyzed and interpreted the articles, and revised the manuscript. HK searched and selected the articles, performed the quality assessment, analyzed and interpreted the articles, and drafted the manuscript. JC designed the study, analyzed and interpreted the articles, and revised the manuscript for important intellectual content. All authors made substantial contributions to the study and approved the submitted version of the manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Search strategies.
[DOCX File (Microsoft Word File), 28 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Characteristics and key findings of the included reports (n=15).
[DOCX File (Microsoft Word File), 27 KB-Multimedia Appendix 2]

Multimedia Appendix 3

Results of quality appraisal of the included reports (n=15).
[DOCX File (Microsoft Word File), 23 KB-Multimedia Appendix 3]

Multimedia Appendix 4

Summary of GPS technologies, monitoring protocols, and GPS-derived or GPS-anchored environmental measures in the included reports (n=15).
[DOCX File (Microsoft Word File), 26 KB-Multimedia Appendix 4]

Multimedia Appendix 5

Associations between GPS measures and psychosocial health indicators (n=15).
[DOCX File (Microsoft Word File), 37 KB-Multimedia Appendix 5]

Checklist 1

PRISMA checklist.
[DOCX File (Microsoft Word File), 26 KB-Checklist 1]

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Abbreviations

MMAT: Mixed Methods Appraisal Tool
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO: International Prospective Register of Systematic Reviews

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